Bambusa vulgaris Schrad ex Wendl. Common bamboo

SO-ITF-SM-65
October 1993

Gramineae Grass family

Bambsoideae Bamboo subfamily

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Bambusa vulgaris Schrad. ex Wendl., known as common bamboo or bambú (Spanish), is a tall, thornless, clump-forming bamboo (fig. 1). The species probably originated in southern Asia where it has been cultivated for thousands of years. Common bamboo is planted today throughout the moist Tropics for a wide variety of products and uses including construction materials and furniture.

HABITAT

Native and Naturalized Range

Common bamboo is found only in cultivation or as a residual from cultivation (*22*). Although its precise center of origin is unknown (*2*), its native range was almost certainly located in southern Asia. The species has been cultivated in Asia for many centuries. All of what must have been the original habitat has been cleared for farming or profoundly altered by cutting and burning.

Common bamboo is now cultivated to some extent throughout the moist Tropics. It was introduced to Puerto Rico at least 150 years ago (*32*). Plantings in Puerto Rico today, mainly along roads and streams, occupy roughly 1,000 ha (author, personal observation). Common bamboo spreads little on its own (except as clumps expand) in these new habitats, but once established, the clumps can persist indefinitely.

Climate

In Puerto Rico, common bamboo is a familiar sight in areas receiving between 1500 and 3800 mm of annual precipitation. Clumps occasionally grow in areas so dry that they defoliate during the dry season (*22*). In dry areas, common bamboo is normally confined to sites near streams and seeps and to locations where it receives runoff from roads (author, personal observation).

Soils and Topography

Common bamboo grows best in continuously moist, well-drained soils, but can withstand short-term flooding (*14*) or water tables within 30 cm of the surface (*22*). The species will not survive prolonged flooding. In Puerto Rico, common bamboo grows in soils where the pH ranges from about 4.5 to 7.5 (author, personal observation). Although common bamboo is one of the more salt-tolerant bamboos, it will not withstand free salt in the soil (*2*). Common bamboo will grow on all soil textures if sufficient moisture is present. Clay or heavy loam soils are more suited to common bamboo than sandy soils because they retain more moisture during dry periods and require less irrigation during the establishment phase (*17*).

Associated Forest Cover

The former primary forest associates of common bamboo are unknown. It grows today with a vast array of secondary forest species in woodlots, on roadsides, and on riverbanks where it has been planted throughout the Tropics. Common arborescent associates in Puerto Rico include *Mangifera indica* L., *Andira inermis* (W. Wright) H.B.K., *Spathodea campanulata* Beauv., and *Erythrina fusca* Lour. (author, personal observation).

LIFE HISTORY

Reproduction and Early Growth

Flowering and Fruiting.—Common bamboo rarely flowers. In fact, flowering has not been observed in recorded

Figure 1.—*Culms in a clump of common bamboo* (Bambusa vulgaris Schrad. ex Wendl.) *growing in Puerto Rico.*

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history in many parts of the world (including Puerto Rico) (*16*). However, there have been sporadic and scattered reports of flowering during the last two centuries in Asia and Oceania (*2*). McClure (*22*) reported that occasional flowering clumps of common bamboo can be found across areas of its range at the beginning of the rainy season and that these flowers are self-sterile. As with other bamboos, flowering results in the death of the culm and the attached rhizome (*19*). However, for this species, usually only scattered culms flower rather than all culms in a clump; thus, whole clumps are not killed by flowering (*5*).

Seed Production and Dissemination.—No information is available on seed production except that it is rare and in many areas, absent (*2*). Seed dissemination is probably by gravity, water, birds, and rodents as is the case with other bamboos and grasses.

Seedling Development.—No specific information is available concerning germination and subsequent development of common bamboo seedlings. If seeds are available, the use of 1- or 2-year-old seedlings in pots or transplants from nursery beds are recommended (*2*).

Vegetative Reproduction.—Common bamboo (fig. 2) is propagated vegetatively by several methods. A common method is to cut a culm above the second or third node and excavate the attached rhizome, severing it from the rest of the rhizomes with an ax (*32*). These explants are planted with the culm stump exposed. Soon after planting, dormant buds at the nodes of the stump produce leafy branches, and within a few months new culms arise from the buried rhizome. This type of propagation has a very high probability of success, but is costly because of the amount of labor involved in excavating the rhizomes. A variation of the method is to use rhizome cuttings (*22*). In this variation, the propagule consists of a few centimeters of the bottom of the culm and the top of the rhizome with roots attached, and it can be collected without excavating the entire rhizome. The propagule is given a shallow covering of soil or compost.

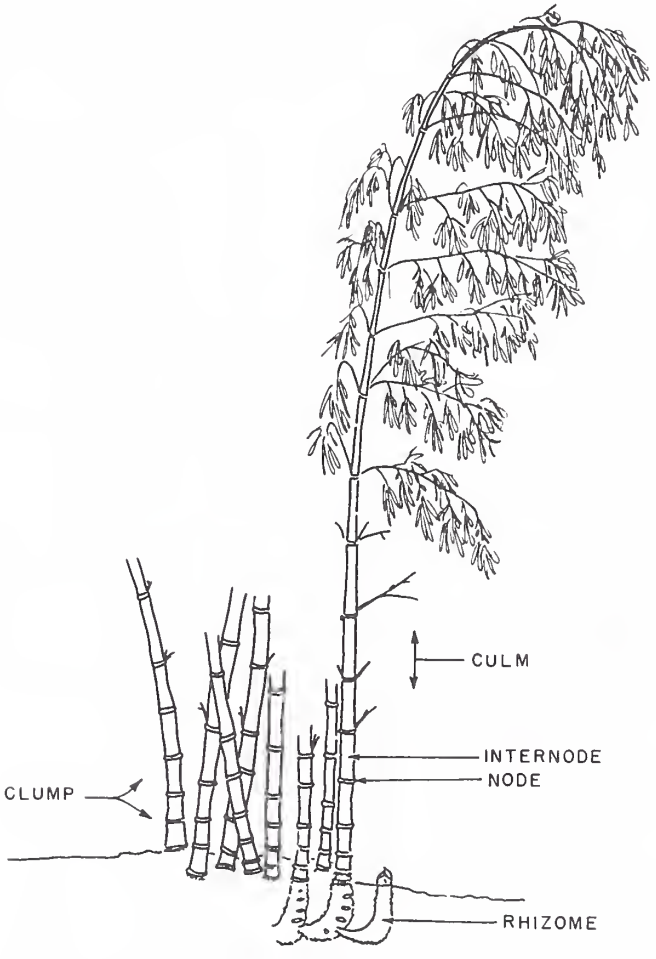

Figure 2.—*A clump of common bamboo* (Bambusa vulgaris Schrad. ex Wendl.) *with parts labeled.*

Common bamboo can also be propagated by burying cuttings comprised of a single node or the whole culm (*32*). It is effective to use cuttings as stakes with at least one node protruding from the soil (*17, 22*). The culms used should be young; rooting ability drops off sharply with age. The rooting of the cuttings can be increased greatly by injecting indoleacetic acid (IAA), kinetin, and other plant hormones into the cavity between nodes (*2, 25*). Propagation from cuttings is often done in the nursery where the new plants are raised for 1 year before being moved to the field. Branch cuttings can also be rooted (*35*). It is necessary to leave a piece of the node attached to the branch cuttings to ensure rooting; 20 to 24 months in the nursery are required before they develop sufficiently to outplant (*13*). A rapid multiplication method by tissue-culture techniques has also been described (*24*).

In a test of 1,019 segments cut from the base of culms in Guatemala, more than 50 percent of cuttings taken from 2- to 30-month-old culms rooted (*22*). A small plantation established by cuttings near the end of the rainy season in the Philippines resulted in a 32-percent survival rate (*3*). The subsequent replanting of cuttings early in the following rainy season yielded a 100-percent survival rate.

The rooting ability of cuttings can be illustrated by whole stands of common bamboo in Jamaica that have arisen through the spontaneous rooting of green culms used for yam stakes (*22*). In Puerto Rico, natural regeneration occurs to some extent along streambanks when rhizomes and culms are washed downstream in floods and then deposited with sediment in overflow areas (author, personal observation). Layering also occurs when live canes are knocked down and then covered by sediment or debris. Rhizomes or pieces of live culms are sometimes transported in fill dirt and generate new clumps.

Irrigation is recommended during the dry season following the planting of cuttings (*32*). In India, annual irrigation allowed the harvest of culms to begin 4 years after planting, whereas 8 years were required without irrigation (*17*). Tests of a complete fertilizer (nitrogen, phosphorus, potassium ratio of 12:10:6) applied at the rate of 1.4 kg per clump 1 and 2 years after planting resulted in a larger average number of culms per clump and a larger percentage of full-sized culms 6 months after the second application than with no fertilization (*32*). A spacing of 12 by 12 m for clumps in new plantations has been recommended (*17*).

Sapling and Pole Stage to Maturity

Growth and Yield.—Although yields of common bamboo on an area basis are not large, growth of individual culms in established clumps is nothing short of spectacular. Culms grow to their maximum height of 10 to 20 m in about 3 months (*19*). Elongation may reach 20 cm per day. Moreover,

from 40 to 50 percent of the daily height growth is actually taking place in only four to six of the internodes (*5*). Bamboo culms are tender during the first year, toughen during the second year, and mature during the third year (*5*). Culms of common bamboo live at least 4 years and, usually, considerably longer.

Culms of newly planted clumps are slender and short. In test plantings of common bamboo in Bangladesh, clumps developed rapidly in the first 2 years but slowed thereafter (*1*). New culms reached the maximum mature height 7 years after clump establishment, and maximum diameters 9 years after clump establishment.

Culms tend to be thickest near the ground with little taper for 6 m or so. Sometimes there is a slight thinning between 1 and 3 m in height. Above 6 m, diameters decrease steadily. Diameters and taper are illustrated in figure 3 for a single, typical culm in a moist forest area in Puerto Rico. Two hundred culms sampled from 20 vigorous clumps of common bamboo in Puerto Rico averaged 8.15 ± 0.09 cm in diameter at breast height (d.b.h.) with a maximum of 13.2 cm in d.b.h. (author, personal observation).

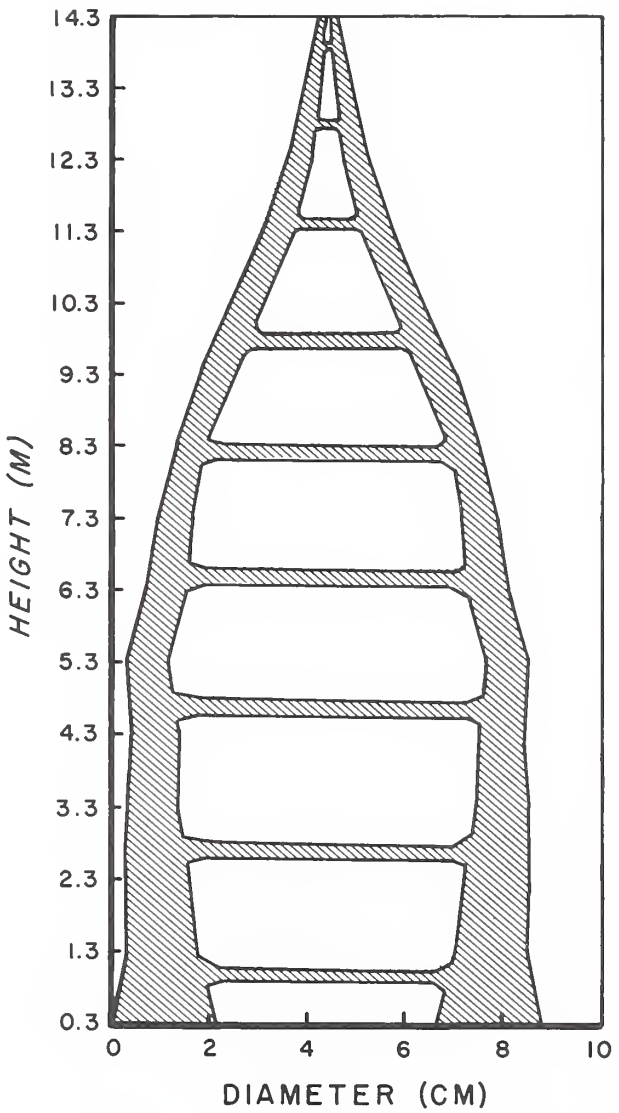

Figure 3.—*Profile of diameter and wall thickness of a typical culm of common bamboo* (Bambusa vulgaris Schrad. ex Wendl.) *sampled in Puerto Rico.*

Proceeding upward from the base, culm wall thickness decreases rapidly at first, then changes little until near the top. Culm wall thickness in Puerto Rican common bamboo is predicted by the equation:

$$Y = 1.076 + 0.036H - 1.133 \log(H) + 0.048D$$

where:

Y = culm wall thickness,
H = height on the culm,
D = diameter of the culm at the point of height measurement,
R = 0.927,
$S.E.$ = 0.171, and
n = 287.

The specific gravity of culm walls averaged 0.68 g/cm^3 (ovendried weight, samples taken from three heights on culm) (*28*). Culm walls shrink an average of 32 percent during ovendrying.

Clumps may contain from a few to several hundred culms. A sample ($n = 20$) of medium-sized clumps indicated an average of 3.70 ± 0.31 sound culms per square meter of clump basal area (author, personal observation). The culms in the exterior of the clumps arch outward so that the crown of the clump is broader than the base. The ratio of clump crown area to clump basal area of 20 clumps measured in Puerto Rico was 4.06 ± 0.17 (author, personal observation).

Plantations of clumps spaced at 12 by 12 m produced almost 10 t/ha/yr (*2*). However, operational yields using a 3.5-year clearcutting cycle were given as 2.3 to 5.1 t/ha/yr (*21*). Trials in the Ivory Coast yielded 15 t/ha/yr (7.5 t dry weight) (*11*). Trials in Trinidad obtained almost 9 t/ha/yr of dry cellulose pulp using a 3-year cutting cycle (*22*).

Harvesting of common bamboo is sometimes done by clear-felling clumps to avoid the difficulties of selecting and extracting the 3- or 4-year-old culms from the tangle of the clump. This practice, however, weakens the clump's root reserves and reduces production. If clear-felling is necessary, it should be done in cycles of more than 3.5 years. Highest production can be achieved with annual harvesting of the 3-year-old culms (*5*). Because the 3-year-old culms are difficult to distinguish from 2-year-old culms, it is sometimes necessary to uniquely mark each year's new culms (*35*). Extra thinning is often desirable in the center of clumps to minimize congestion. Congestion both reduces production and hinders harvesting. Harvesting should be avoided during the wet season when new culms are growing.

During harvesting operations, limbs are pruned as high as possible to ease extraction. In the past, harvesting was done with handsaws or machetes. Small chain saws would probably increase daily worker productivity considerably. A small, tractor-mounted winch would facilitate extraction of the culms from the tangle of clumps.

It is sometimes necessary to kill clumps of common bamboo, although it can be a daunting task. Bulldozing the clump is a common approach. Alternatively, a clump can be clearcut, and the resprouting culms cut, burned, or treated with herbicides (*6*).

Rooting Habit.—The culms are supported by large, upward-curving rhizomes that are thinnest at the point of attachment and bulbous near the end where the culm arises.

The rhizomes are connected to the rhizomes of the previous generation and give rise to the succeeding generation. These rhizomes in turn produce tough, fibrous roots that thoroughly permeate the upper 30 cm or more of soil (*32*). As a result of the roots and abundant litter that accumulates, common bamboo is very effective in preventing gully and rill erosion (*19*).

Reaction to Competition.—Clean cultivation is not necessary during establishment of common bamboo (*32*). If a mulch is applied around the transplants or cuttings, mowing to prevent overtopping by grass and weeds is sufficient. After 3 or 4 years, the clumps are dense enough to shade out weeds. Common bamboo is so competitive that hardwoods or vines are rarely able to grow up through the clumps (author, personal observation).

The shade tolerance of common bamboo seedlings is unknown. New clumps from cuttings can grow in light shade. Clumps probably need overhead sunlight in order to fully develop.

Damaging Agents.—Common bamboo plants have relatively few enemies. However, the rhinoceros beetle *Podischnus agenor* (Ol.) burrows into young shoots in Guatemala (*12*). The scale *Asterolecanium bambsae* (Boisduval) is abundant on common bamboo culms in Puerto Rico (*20*); it is unknown if it causes significant growth loss. A very serious disease called bamboo blight, caused by the fungus *Sarocladium oryzae* (Sawada), has been decimating common bamboo in Bangladesh in recent years (*27*). The blight can be partially controlled with fungicides and cultural practices. Common bamboo is not frost hardy. At −1 °C it suffers foliar damage, and at −2 °C it is killed to the ground (*35*).

The most serious impediment to the use of common bamboo in Puerto Rico, and possibly around the world, is the bamboo powderpost beetle *Dinoderus minutus* (F.) that riddles dry bamboo (*19, 20*). Another species, *Lyctus planicollis* Lec., is cosmopolitan (*35*). Other *Lyctus* species have been noted attacking bamboo in Puerto Rico and Florida (*20, 35*). The wood is also very susceptible to attack by the West Indian dry-wood termite, *Cryptotermes brevis* (Walker) (*34*).

Susceptibility of culms of harvested common bamboo to attack by powderpost beetles is governed, to a great extent, by the starch content of the particular harvested piece (*4, 26*). The bottoms of the culms are less susceptible than the tops, and culms 3 years or older are less susceptible than younger ones (*26*). Reducing the starch content greatly reduces a culm's attractiveness to the pest. Some traditional methods of treatment include curing the culms by cutting and leaving them standing in the clump for several weeks, smoking the culms, and soaking the culms in water for several weeks (*4*). These methods are fairly effective in controlling powderpost beetle attack. However, the water-soaking method changes the color of the culms and leaves them somewhat brittle. Soaking or injection treatments of insecticides, copper salts, and synthetic resins provide nearly complete control; brushing chemicals on the outside is less effective (*26*).

A test using several bamboo species indicated that the heaviest decay was caused by a soft-rot fungus, *Chaetominum globusum*, and a brown-rot fungus, *Coniophora puteana* (*4*). There was no difference in decay resistance among bamboo species.

Common bamboo is quite wind resistant. Only winds of hurricane force have any effect on clumps. In very high winds (such as those of Hurricane Hugo that passed over Puerto Rico in 1989), all the culms in clumps can be broken and bent over at a height of 3 or 4 m. Following such breakage, clumps return to their normal appearance and density within about 2 years (author, personal observation).

SPECIAL USES

Common bamboo is used for a variety of purposes (*1, 19, 22, 29, 32, 33*). Although subject to powderpost beetle attack, it is commonly used as a building material. Structural properties of culms and splints have been tested and reported (*30*). Whole culms are used for poles, props, and scaffolding. Split culms are woven into partitions, used as roofing, and serve as lath in plaster. Common bamboo also finds wide application in the production of furniture, utensils, handicrafts, banner poles, and temporary water pipes. About 80 percent of Asia's bamboo consumption is for construction materials and other local uses.

Treated and untreated culm sections are commonly used as fenceposts. Service life of untreated posts is only 1.3 years, but it can be extended to several times that by preservative treatment (*8*). It is necessary to knock out internodes or drill holes between nodes to allow the preservative to penetrate from the inside of the culm wall. Stakes and props cut from this species are very important in the cultivation of many tropical fruit and vegetable crops. The dry culms are regularly used as firewood in many areas.

A number of studies have concluded that common bamboo is one of the best bamboos for making paper (*2, 7, 9, 10, 15, 23*). Its fiber length is reported to average 2.33 mm, similar to the longer fibered hardwoods (*10*). Although some 80 small paper mills in India depend wholly or partly on bamboo for raw material, worldwide consumption of bamboo for pulp is still negligible (*29*).

The tender growing tips of new culms can be prepared for bamboo shoots in Oriental cuisine by boiling for half an hour and changing the water once or twice to get rid of the bitter taste (*19*). The species is regularly used for this purpose in

Figure 4.—*Common bamboo* (Bambusa vulgaris Schrad. ex Wendl.) *planted to stabilize a reservoir shoreline in Puerto Rico.*

Asia and, to a lesser extent, in the New World (*29, 33, 35*). A number of preparations of common bamboo are used in herbal medicine (*18*).

Common bamboo is very useful in conservation plantings. Most plantings in Puerto Rico were established as protection against streambank erosion and to stabilize road fill (author, personal observation). It also does an excellent job in protecting watersheds and shores of reservoirs (fig. 4). Common bamboo is widely planted as an ornamental and for barriers, screens, cattle shade, and windbreaks (*19*).

GENETICS

A horticultural variety known as *B. vulgaris* cv. Vittata McClure (also known as var. *stricta* and var. *striata*) that has golden-yellow culms with a few slender, green stripes makes a very attractive ornamental (*35*). The variety is said to have originated in Japan or China (*3*). Another cultivar, which has shortened and inflated internodes, is known (*22*). Common bamboo has been determined to have 2n = 72 chromosomes (*31*).

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*U.S. GOVERNMENT PRINTING OFFICE:1993-565-016/80036